TEK5010 Multiagent systems

Lecture 5: Swarm robotics 2

Exercise: Urn models

Question 1

A swarm of 10 robots have reached a two-way split in their path. In this case, the swarm is programmed to use urn models for collectively deciding which way to travel when reaching junctions.

a) Could you explain the generalized equation for urn models given by:

$$\Delta B(\,B) = 4\,(P_{FB}\left(\frac{B}{N}\right) - \frac{1}{2})\,(\frac{B}{N} - \frac{1}{2})$$

b) What urn model would you employ if all robots were to converge on one of the two ways? Could you calculate the expected change in the ratio (i.e. robot opinion of which way to travel) for one iteration assuming an initial distribution of 35/65% (assuming $\#o_A/\#o_B$)? What if initial distribution is 10/90% or 49/51/?

c) What urn model would give a 50/50% split of the swarm between the two ways?

d) Or if we want a 77/23% split between the two ways?

e) Optional: Could you simulate the end state of the different algorithms?